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PROCESSING FLUENCY SCALE DEVELOPMENT FOR CONSUMER RESEARCH

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Abstract

Processing fluency or the subjective experience of ease that consumers can experience when processing information, is a prominent construct in consumer research. Despite its prevalence, however, its measurement has been inconsistent. The present research addresses this methodological gap in the literature by developing and testing a scale for assessing the subjective experience of processing fluency. This scale demonstrates strong evidence of convergent and discriminant validity, reliability, and nomological validity across different processing fluency manipulations and marketing contexts. Use of this scale will allow marketing practitioners and academicians to consistently measure a psychological state that is known to have ubiquitous effects on downstream consumer outcomes including trust, attitude, and choice. Researchers can administer this four-item scale by having participants indicate their agreement (1 = strongly disagree, 7 = strongly agree) on whether a given marketing communication (e.g., ad copy) is: (1) difficult to process, (2) difficult to read, (3) takes a long time to process, (4) difficult to understand.

Keywords: scale development; processing fluency; information processing; consumer behavior

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Introduction

In addition to the thoughts and ideas marketing communications (e.g., ad copy) may engender, merely the experience of processing these communications has been shown to affect consumer judgement (for a review, see Alter and Oppenheimer, 2009). Processing fluency or the subjective experience of ease resulting from the act of information processing exists along a continuum ranging from effortless to highly effortful. Easily processed information leads consumers to experience high processing fluency, which is often felt as positive affect, and can impact downstream consumer outcomes such as attitude, trust, and choice (Brinol et al., 2006; Kostyk et al., 2017b; Winkielman and Cacioppo, 2001).

Many aspects of information processing, including linguistic, perceptual, spatial, and conceptual processing, can give rise to processing fluency (Alter and Oppenheimer, 2009). A brand message, for instance, can be altered to increase or decrease the effort needed to process it; e.g., by displaying the message in the perceptually difficult **Haettenschweller** font or the relatively easier to perceive **Impact** font (Simmons and Nelson, 2006). The use of an easy-to-perceive font should increase processing fluency and, in turn, may increase liking of the brand message (Alter et al., 2007; Novemsky et al., 2007; Reber et al., 1998; Winkielman et al., 2003). In addition to font type, processing fluency is elicited by visual clarity and contrast, simplicity, prototypicality, congruity, and even rhyme (Brinol et al., 2006; Winkielman et al., 2003). Regardless of elicitation method, processing fluency has been shown to have consistent effects on consumer judgment (Alter and Oppenheimer, 2009; Schwarz, 2004). The measurement of processing fluency, however, has been less consistent. Much of previous research has assumed that differential processing fluency can be elicited between participants by manipulating objective differences in the presentation of otherwise identical information (e.g., presenting an image

against a high or low contrast background; Reber et al., 1998). While the findings of such research suggest that observed differences between participants are the result of differential processing fluency, whether this is the case remains unknown without explicitly measuring each participant's subjective experience of processing fluency.

Some attempts have been made to directly assess the subjective experience of processing fluency using self-report measures (Labroo et al., 2008; Song and Schwarz, 2008; Song and Schwarz, 2009). For instance, Song and Schwarz (2008; 2009) used single-item measures and Labroo et al. (2008) used a three-item measure. The three-item measure from Labroo et al. (2008) has become the most commonly used processing fluency scale among consumer behavior researchers; however, its convergent, discriminant, and nomological validity have not been assessed. In light of these limitations, the goal of the present research is to develop and validate a new processing fluency scale. This scale is validated across a variety of marketing contexts and experimental manipulations and provides marketing academics and practitioners with a valid and reliable way to assess the extent that consumers experience processing fluency.

Background

The experience of processing fluency is felt by consumers as generalized positive affect (Monahan et al., 2000; Winkielman and Cacioppo, 2001). As a result, an increase in processing fluency typically has a positive effect on subsequent consumer outcomes including attitude (Labroo et al., 2008; Lee and Labroo, 2004), trust (Kostyk et al., 2017a; Reber and Schwarz, 1999; Rennekamp, 2012; Schwarz, 2004; Skurnik et al., 2005), and choice (Kostyk et al., 2017b; Labroo et al., 2008; Novemsky et al., 2007). For example, Kostyk et al. (2017a, 2017b) found that when product ratings on social media platforms such as Amazon and TripAdvisor were

presented in an easier-to-process format consumers perceived the ratings to be more trustworthy and had higher purchase intentions.

However, despite the ubiquity of the processing fluency construct in consumer research and its effect on various consumer outcomes, its measurement in the marketing literature has been inconsistent. Previous research has largely assumed that processing fluency is an underlying process without measuring it directly. For example, many studies have used font manipulations as a proxy for manipulating processing fluency (Alter et al., 2007; Cruz et al., 2017; Novemsky et al., 2007; Simmons and Nelson, 2006). Such studies assign participants to conditions in which information is presented in font that is easy or difficult to process. In turn, differences between conditions on outcome measures are attributed to differential processing fluency that is assumed to have resulted from the manipulation.

Other studies have used contrast manipulations as a proxy for manipulating processing fluency (Brinol et al., 2006; Hansen et al., 2008; Laham et al., 2009; Reber et al., 1998). For example, researchers have varied the figure-ground contrast of an image to manipulate the processing difficulty of a target object relative the background. In turn, higher figure-ground contrast is thought to result in higher processing fluency (Reber and Schwarz, 1999). Manipulating the readability of written information is another way in which researchers have assumedly manipulated processing fluency (Lowrey, 1998; Oppenheimer, 2006). Oppenheimer (2006), for example, manipulated dissertation abstracts by replacing simple words with more complex words, positing that simpler words would be easier to read and thus be more likely to give rise to processing fluency.

The results of such studies have had important implications in consumer research (Alter and Oppenheimer, 2009); however, without explicitly measuring processing fluency, it is

unknown whether the studies' experimental manipulations actually gave rise to the subjective experience of processing fluency. Manipulation checks on processing fluency are often not employed (Brinol et al., 2006; Simmons and Nelson, 2006), and a meta-analysis of empirical articles investigating processing fluency suggests that less than 20% employed a direct measure of the subjective experience of processing fluency (Graf et al., 2017).

Seemingly circumventing the need for a subjective measure of processing fluency, some prior studies have relied on objective measures to gauge the construct. Specifically, recognition speed has been used to assess processing fluency of textual information as well as images (Reber et al., 1998; Whittlesea and Williams, 1998; Whittlesea, Bruce W. A. and Williams, 2001). In one experiment, the authors measured response time in milliseconds to assess participant's ease-of-processing product images in various orientations (Leonhardt et al., 2015). It was assumed that response time served as an adequate measure of participants' subjective experience of processing fluency, with shorter response times suggesting higher processing fluency.

However, because processing fluency is defined as the subjective experience of ease that takes place when consumers process information (Alter and Oppenheimer, 2009), it is dependent on the subjective experiences rather than on objective factors, such as response time. A consumer might *feel* that information is easy to process, independent of the duration needed to process the information. Objective measures fail to account for individual differences that might affect the extent that someone experiences processing fluency (Haugtvedt et al., 1992; Peters et al., 2006). To overcome such difficulties, self-report measures of consumers' subjective experiences should be employed.

However, self-report measures have been used inconsistently throughout the processing fluency literature (Alter and Oppenheimer, 2009; Labroo et al., 2008; Song and Schwarz, 2008;

Song and Schwarz, 2009). Approximately 50% of the empirical studies that have used self-reports to measure processing fluency employed a single-item measure (Graf et al., 2017). For example, Song and Schwarz (2009) assessed processing fluency elicited from product names by asking participants how easy the names were to pronounce (1 - very difficult, 7 - very easy). In another study, (Song and Schwarz, 2008) used a one-item scale to assess the extent that processing fluency was elicited from reading a text by asking how easy it was to read (1 - very difficult, 7 - very easy). However, construct measurement via single-item scales poses serious limitations outside of specific contexts (Bergkvist and Rossiter, 2007).

The most popular multi-item processing fluency scale used in the literature comes from research by Labroo et al. (2008). This scale consists of three items measured on a 7-point rating scale with the following endpoints: “not at all attractive” to “very attractive”, “not at all eye-catching” to “very eye-catching”, and “difficult to process” to “easy to process”. While it is likely superior to a one-item scale, the convergent, discriminant, and nomological validity of this scale have not been tested. Other multi-item measures of processing fluency, which are less common in the literature, suffer from the same limitations (DeMotta et al., 2016; Landwehr et al., 2011; Lee et al., 2010). Thus, the present research will generate and validate a reliable multi-item scale to assess the subjective experience of processing fluency.

In what follows, four empirical studies are conducted to develop and validate a new processing fluency scale. Across the studies, we test the new scale’s ability to capture differential processing fluency using standard processing fluency manipulations from the literature, including contrast (Laham et al., 2009; Reber et al., 1998; Reber and Schwarz, 1999), font (Alter et al., 2007; Cruz et al., 2017; Novemsky et al., 2007; Simmons and Nelson, 2006), and

readability manipulations (Lowrey, 1998; Oppenheimer, 2006). In addition, we compare the performance of the new scale to that of the commonly used scale from Labroo et al. (2008).

Study 1: Scale Development

Measures and Procedure

Two hundred and ninety participants (57% women, 18-63 years old) were recruited using Amazon Mechanical Turk (Hulland and Miller, 2018). Here, and in our subsequent studies, sample size was determined based on the standard guidelines for structural equation modeling, as well as the guidelines for CFA models with factor loadings of .65 (Kline, 2011; Wolf et al., 2013). Participants were presented with a webpage of a nondescript hotel brand and were asked to respond to several measures. Consumer trust was measured on a 1 (strongly disagree) to 5 (strongly agree) scale using three items ($\alpha = 0.94$): “This hotel is trustworthy”, “This hotel gives me a feeling of trust”, and “I have trust in this hotel” (De Wulf et al., 2001). Positive affect was assessed using the 10-item PANAS positive affect subscale ($\alpha = 0.87$; (Watson et al., 1988). Purchase intention was assessed by asking participants how likely they were to book the hotel for their vacation (1 - very unlikely to 7 - very likely; Novemsky et al., 2007). To measure processing fluency of the webpage, initial items were generated from an extensive review of the literature. A panel of ten subject-matter experts evaluated the items, as part of a larger pool of items, and compared them against a set of formally defined constructs. Items correctly matched with their construct with at least 80% accuracy were retained in the pool (Bearden et al., 1989; Churchill, 1979). Twelve of the initial items met this criterion and were included in our subsequent analyses (Table 1).

(Insert Table 1 about here)

Convergent and Discriminant Validity

Confirmatory factor analysis, performed on all 12 items, was followed by testing the full structural equation model (Anderson and Gerbing, 1988). This process reduced the model to four items (Table 1). The model suggested adequate fit ($\chi^2 (df=2) = 0.453, p = 0.80, AGFI = 0.99, RMSEA < 0.05$; Byrne, 2010). Modification indices analysis did not suggest any sub-dimensions underlying the construct. The standardized residual covariance matrix indicated that all items behaved in a similar manner and all standardized item loadings were higher than 0.5, suggesting convergent validity (Anderson and Gerbing, 1988). In addition, within-construct variance was compared to between-construct variance. In all cases, the average variance extracted (AVE) for each construct was higher than the squared structural link shared by constructs; AVE was also higher than 0.5, suggesting evidence of discriminant validity (Fornell and Larcker, 1981). Finally, the reliability of the four-item scale was assessed ($\alpha = 0.87$; Table 2).

(Insert Table 2 about here)

Nomological Validity Assessment

Next, the new scale was tested for evidence of nomological validity (Churchill, 1999). Testing for nomological validity helps to ensure that the new scale is indeed measuring the construct of processing fluency. This is achieved by assessing the degree to which the measured construct, i.e., processing fluency, behaves as expected in relation to other theoretically relevant constructs in a structural model often referred to as the nomological network (Cronbach and Meehl, 1955; Hagger et al., 2017). Based on previous research, processing fluency should be positively correlated with consumer trust, positive affect, and purchase intention (Alter and Oppenheimer, 2009). In addition, a theory-grounded path from consumer trust to purchase intention was included in the model (Darley et al., 2010). Path analysis with reliabilities (performed using AMOS for SPSS) showed adequate fit for the structural model ($\chi^2 (df=1) =$

3.59, $p = 0.06$, AGFI = 0.94, CFI = 0.99, TLI = 0.95, RMSEA < 0.05; Byrne, 2010). Overall, processing fluency and its related constructs correlated in a manner predicted by theory, providing initial evidence for nomological validity (Table 3). Processing fluency was positively correlated with consumer trust ($\beta = 0.38$, $p < 0.01$) and purchase intention ($\beta = 0.12$, $p < 0.05$), and positive affect partially mediated the relationship between processing fluency and consumer trust ($\beta = 0.44$, $p < 0.01$).

(Insert Table 3 about here)

Discussion

Study 1 finds that the new processing fluency scale is unidimensional – with evidence of convergent validity – and reliable, and it shows evidence of nomological validity. Our subsequent studies will test the scale’s ability to capture processing fluency resulting from established procedures used in previous research and assess its performance across variables of interest to marketing practitioners and academics (Peter and Churchill, 1986). For instance, consumer attitude is a relevant measure and should be included in the nomological network.

Study 2: Contrast Manipulation

Varying figure-ground contrast is an established way to manipulate processing fluency (Brinol et al., 2006; Laham et al., 2009; Reber et al., 1998; Reber and Schwarz, 1999). Study 2 employs this manipulation to assess the new scale’s ability to capture differential processing fluency.

Sample and Procedures

A total of 134 respondents were recruited as in the previous study (53% women, $M_{\text{age}} = 34.3$, $SD_{\text{age}} = 11.2$). Participants imagined they were shopping online for a new water bottle and were shown a product advertisement. Between-participants, an advertisement for a water bottle

was manipulated to have either high or low figure-ground contrast (Appendix B). Attitude toward the product was measured by asking participants: “What is your opinion of this water bottle?” (1 - very unfavorable to 7 - very favorable; Novemsky et al., 2007). Processing fluency was measured using the new four-item scale, as well as the existing three-item scale initially used by Labroo et al. (2008). Trust and purchase intention were measured as in the previous study. Familiarity with the product category and demographics were also collected.

Unidimensionality, Reliability, and Nomological Validity

The new scale demonstrated strong evidence of unidimensionality and reliability based on critical values, i.e., factor item loadings above 0.7, within-construct variance above 0.5 and higher than between-constructs variance, and reliability above 0.7 (Bagozzi, 1980; Fornell and Larcker, 1981; Nunnally, 1978). The new scale was also assessed to determine whether it captured differential processing fluency resulting from the figure-ground contrast manipulation. Processing fluency, as measured on the new scale, differed significantly across the high and low figure-ground contrast conditions ($F(1, 132) = 9.52, p < .01$). As expected, processing fluency was higher in the high contrast condition than in the low contrast condition ($M_{HC} = 6.02, SD_{HC} = 1.11$ vs. $M_{LC} = 5.36, SD_{LC} = 1.29, p = 0.002$; Cohen’s $d = 0.6$). Familiarity with the product category and primary language were included as control variables; however, none reached significance (F ’s < 1).

Similar to Study 1, nomological validity of the new scale was assessed by testing the full structural model through path analysis with reliabilities (Appendix A). The dependent variables included consumer attitude, perceived trust, and purchase intention. Two theory-grounded paths from consumer trust to purchase intention and from consumer attitude to purchase intention were included in the model (Chow and Holden, 1997; Macintosh and Lockshin, 1997). When

processing fluency was operationalized using the new scale, the analysis suggested good fit for the structural model ($\chi^2 (df=3) = 1.72, p = 0.63, AGFI = 0.97, RMSEA < 0.05$), and it successfully captured differential processing fluency resulting from the figure-ground contrast manipulation ($p < 0.01$). The standardized regression coefficients suggest that the relationship between processing fluency and purchase intention was mediated by consumer attitude; however, there was not a direct effect of consumer trust on purchase intention (Table 4).

(Insert Table 4 about here)

Scale comparison

The existing three-item scale (Labroo et al., 2008) demonstrated acceptable levels of reliability; however, it exhibited unacceptably low factor loadings. Separate path analysis with reliabilities suggested adequate fit for the structural model ($\chi^2 (df=3) = 0.37, p = 0.78, AGFI=0.98, RMSEA < 0.05$); however, the existing scale failed to provide evidence of nomological validity by not capturing differential processing fluency from the figure-ground contrast manipulation ($p > 0.4$). Table 5 summarizes the performance of the new and existing scales.

(Insert Table 5 about here)

Discussion

The new processing fluency scale demonstrated strong evidence of convergent and discriminant validity, and reliability. The new scale also provided evidence of nomological validity by capturing differential processing fluency from a figure-ground contrast manipulation used in previous research (Reber et al., 1998). In addition, the structural model produced adequate fit when the new scale was used to measure processing fluency in a nomological

network that included consumer trust, consumer attitude, and purchase intention as dependent variables.

Study 3: Font Manipulation

Font manipulation has served as a prominent way to manipulate processing fluency (Alter et al., 2007; Cruz et al., 2017; Novemsky et al., 2007; Simmons and Nelson, 2006). In such studies, stimuli are varied such that their font is more or less difficult to read; easier-to-read font is thought to elicit higher levels of processing fluency.

Sample and Procedures

A total of 133 respondents were recruited as in the previous studies ($M_{\text{age}} = 35.8$, $SD_{\text{age}} = 11.6$, 52% female). Participants were randomly assigned to either the easy-to-read font condition (i.e., 12-point Tahoma font) or the difficult-to-read font condition (i.e., 10-point Haettenschweiler font; Simmons and Nelson, 2006). All participants imagined they were shopping for a tablet online, and they were presented with a product description of a tablet available on Amazon.com. Brand identifiers were removed, and tablet information was held constant across conditions (Appendix C). After participants read the product description, they reported their attitude, trust, and purchase intention. Processing fluency was measured using the new and the existing (Labroo et al., 2008) scales. Familiarity with the product category and demographics were also collected.

Unidimensionality, Reliability, and Nomological Validity

The new scale demonstrated strong evidence of unidimensionality and reliability (Bagozzi, 1980; Fornell and Larcker, 1981; Nunnally, 1978). It also captured differential processing fluency from the font manipulation ($F(1, 131) = 51.32$, $p < .01$). Processing fluency was significantly higher in the easy-to-read font condition than in the difficult-to-read font

condition ($M_{EF} = 5.30$, $SD_{EF} = 1.32$ vs. $M_{DF} = 3.44$, $SD_{DF} = 1.65$, $p < .001$, Cohen's $d = 1.3$). Familiarity with the product category did not significantly interact with font conditions ($p = .32$). Nomological network analysis was also performed that included processing fluency, measured using the new scale, along with consumer attitude, consumer trust, and purchase intention as dependent variables (Appendix A). Path analysis with reliabilities resulted in adequate structural fit ($\chi^2 (df=3) = 0.60$, $p = 0.62$, AGFI = 0.97, RMSEA < 0.05). The standardized regression coefficients were also consistent with the theory (Table 4).

Scale Comparison

The existing processing fluency scale (Labroo et al., 2008) exhibited unacceptably low factor loadings, and lower levels of reliability, when compared to the new scale (Table 5). However, the existing scale did capture differential processing fluency from the font manipulation ($F(1, 132) = 40.56$, $p < .01$). Processing fluency was significantly higher in the easy-to-read font condition than in the difficult-to-read font condition ($M_{EF} = 4.41$, $SD_{EF} = 1.33$ vs. $M_{DF} = 2.92$, $SD_{DF} = 1.39$, $p < .001$, Cohen's $d = 1.10$). In addition, use of the existing scale in the structural model resulted in adequate model fit ($\chi^2 (df=3) = 0.27$, $p = 0.85$, AGFI = 0.98, RMSEA < 0.05).

Discussion

The new processing fluency scale demonstrated strong evidence of convergent and discriminant validity, and reliability. On the other hand, the existing scale (Labroo et al., 2008) exhibited lower levels of reliability, and unacceptably low factor loadings. Both scales captured differential processing fluency from the font manipulation, and they both demonstrated adequate model fit when tested in a full structural model that included consumer attitude, consumer trust, and purchase intention.

Study 4: Readability Manipulation

Marketing communications are often text-based, and their readability level may vary independent of their semantic meaning. Previous research has used readability to manipulate processing fluency (Lowrey, 1998; Oppenheimer, 2006). Study 4 employs a readability manipulation to further assess the new scale.

Sample and Procedures

One hundred and thirty-six participants were recruited as in the previous studies ($M_{\text{age}} = 35.6$, $SD_{\text{age}} = 11.2$, 53% male). Participants imagined they were shopping for a desk, and they were presented with ad copy for a nondescript desk (Appendix D). The readability of the ad copy was manipulated between conditions. A high readability text version was adapted from a product description found on Amazon.com, while a low readability text version was created by substituting nouns, verbs, and adjectives in the high readability text with their longest applicable thesaurus entries (Oppenheimer, 2006). This procedure resulted in the high readability ad copy having a Flesch readability score (0 = very low readability, 100 = very high readability) of 72.9 and the low readability ad copy having a Flesch readability score of 49.2. After reading the ad copy specific to their condition, participants reported their attitude, trust, and purchase intention. Processing fluency was measured using the new and existing scales. Familiarity with the product category and demographics were also collected.

Unidimensionality, Reliability, and Nomological validity

The new scale demonstrated strong evidence of convergent and discriminant validity, and reliability (Table 4), and it successfully captured differential processing fluency from the readability manipulation ($F(1, 134) = 4.87$, $p < .05$). Processing fluency was higher in the high readability condition than in the low readability condition ($M_{HR} = 5.65$, $SD_{HR} = 1.33$ vs. $M_{LR} =$

5.12, $SD_{LR} = 1.45$, $p = 0.02$, Cohen's $d = 0.4$). Primary language and familiarity with the product category did not interact with readability. A structural model using path analysis with reliabilities was used to assess nomological validity (Appendix A). When processing fluency was operationalized using the new scale, the analysis suggested good fit for the structural model ($\chi^2 (df=3) = 1.34$, $p = 0.24$, AGFI = 0.94, RMSEA = 0.04). Standardized regression coefficients were in line with the theory, and the relationship between processing fluency and purchase intention, and between processing fluency and consumer trust, respectively, were mediated by consumer attitude (Table 4).

Scale Comparison

The existing scale (Labroo et al., 2008) demonstrated adequate reliability, but had unacceptably low factor loadings and poor convergent validity (Table 5). In addition, the existing scale did not capture differential processing fluency from the readability manipulation ($p = .26$). Path analysis with reliabilities suggested less than adequate fit for the structural model ($\chi^2 (df=3) = 1.38$, $p = 0.25$, AGFI = 0.93, RMSEA = 0.06). As a result, unlike the new processing fluency scale, the existing scale failed to demonstrate evidence of nomological validity.

Discussion

In the context of a readability manipulation, the new processing fluency scale outperformed the existing scale on every measure. More importantly, the new scale captured differential processing fluency from the manipulation at a statistically significant level and in the direction supported by previous research. The structural model also suggested good fit and provided evidence of nomological validity.

General Discussion

Despite its prevalence in marketing research, processing fluency's measurement has been inconsistent. The present research addressed this problem by developing and testing a new multi-item processing fluency scale. In study 1, scale item generation and purification procedures led to the development of a new four-item scale. The scale asks participants to indicate their agreement (1 = strongly disagree to 7 = strongly agree) on whether the four scale items (difficult to process, difficult to read, takes a long time to process, difficult to understand) describe their experience with a given marketing communication. In testing this four-item scale, we found evidence of convergent, discriminant, and nomological validity, as well as good reliability. In the subsequent studies, the new scale was tested across different samples, processing fluency manipulations, and marketing contexts. This allowed for a robust assessment of the new scale's internal and external validity, as well as its performance against a highly cited existing processing fluency scale, initially from Labroo et al. (2008). The new scale outperformed the existing scale and demonstrated strong evidence of convergent and discriminant validity, reliability, and nomological validity.

Thus, the new scale is recommended over previous measures of processing fluency. Use of this scale should facilitate theory development and allow scholars to isolate effects of processing fluency more accurately in marketing contexts. This is important, as processing fluency can explain consumer behavior in situations where established theories (Kahneman and Tversky, 1979; von Neumann and Morgenstern, 1947) fail to account for observed effects (e.g., Schwarz, 2004). In addition, high measurement error in previous research could have prevented researchers from discovering significant effects where they existed. The new scale will also allow scholars to use processing fluency as a dependent, mediating, control, or moderating

variable to better understand consumer behavior, with the additional rigor that comes with extensive scale testing.

Measuring processing fluency levels associated with consumer exposure to marketing materials is a known indicator of market potential (Schwarz, 2004). With the new scale, marketing practitioners have an additional tool to assess the potential success of new marketing materials and understand the process underlying varied consumer outcomes (Brinol et al., 2006; Kostyk et al., 2017b; Reber et al., 1998; Reber and Schwarz, 1999; Rennekamp, 2012; Schwarz, 2004). In addition, additional processing fluency research and its associated applications are likely to emerge in the future, especially as applied to new media and devices (Schwarz, 2015; Simonson, 2015). In this context, a rigorously tested measure of processing fluency is needed, and the present research takes an important step in that direction.

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Tables

Table 1 - Scale Purification

Scale items [†] Please indicate the extent to which you agree (1 = strongly disagree to 7 = strongly agree) that the marketing communication was:	Standardized factor loadings
Illogical	N/A
Unclear	N/A
Ambiguous	N/A
<i>Not eye-catching</i>	0.52
<i>Not attractive</i>	0.55
<i>Takes a long time to read</i>	0.69
<i>Poorly structured</i>	0.61
<i>Poorly organized</i>	0.65
<i>Difficult to recognize</i>	0.64
<i>Difficult to see</i>	0.61
<i>Difficult to pronounce</i>	0.67
<i>Difficult to process</i>	0.89
<i>Difficult to read</i>	0.72
<i>Takes a long time to process</i>	0.73
<i>Difficult to understand</i>	0.83
Average variance extracted	0.79
Cronbach's alpha	0.87

[†] Scale items that are italicized successfully passed the face validity pretesting and were included in the subsequent statistical analyses (Bearden et al., 1989; Churchill, 1979); The scale items in bold represent the four items retained in the new processing fluency scale, and were included in the final model (see Table 2).

Table 2 - Discriminant validity and reliability assessment of the final model in Study 1[†]

Constructs (# of scale items)	<i>M</i>	<i>SD</i>	AVE	Processing fluency	Trust	Positive affect	Purchase intention
Proc. fluency (4)	17.07	3.08	0.79	(0.87)			
Trust (3)	11.74	2.05	0.84	0.375***	(0.94)		
Positive affect (3)	9.27	3.09	0.77	0.116*	0.444***	(0.87)	
Purch. intention (1)	5.68	1.21	0.81	0.118**	0.747*	0.100*	(0.90)

[†]Alpha reliabilities reported on the diagonal in parentheses. Standardized correlation coefficients between constructs reported below the diagonal. *M* = mean, *SD* = standard deviation, AVE = average variance extracted.

* $p < 0.10$; ** $p < .05$; *** $p < .01$

Table 3 - Standardized coefficients in Study 1[†]

Independent variable	Dependent variable		
	Trust	Positive affect	Purchase intentions
Proc. fluency	0.375***	0.116*	0.118**
Trust	-	-	0.747***
Positive affect	0.444***	-	-

[†] Significant coefficients: * $p < 0.10$; ** $p < .05$; *** $p < .01$

Table 4 – Direct path standardized coefficients [†]

	Contrast manipulation		Font manipulation		Readability manipulation	
	New scale	Old scale	New scale	Old scale	New scale	Old scale
Processing fluency x Manipulation	0.30***	0.06	0.55***	0.54***	0.20**	0.09
Processing fluency x Attitude	0.35***	0.78***	0.30***	0.37***	0.38***	0.63***
Processing fluency x Trust	0.09*	0.20*	0.08	0.14*	0.07	0.32***
Processing fluency x Purchase intention	0.06	0.24*	0.10*	-0.04	0.06	0.04
Attitude x Trust	0.80***	0.66***	0.78***	0.75***	0.43***	0.25**
Attitude x Purchase intention	0.87***	0.76***	0.82***	0.81***	0.22**	0.22*
Trust x Purchase intention	-0.06	-0.06	0.18*	0.17*	0.28***	0.29***

[†] Significant coefficients: * $p < 0.10$; ** $p < .05$; *** $p < .01$

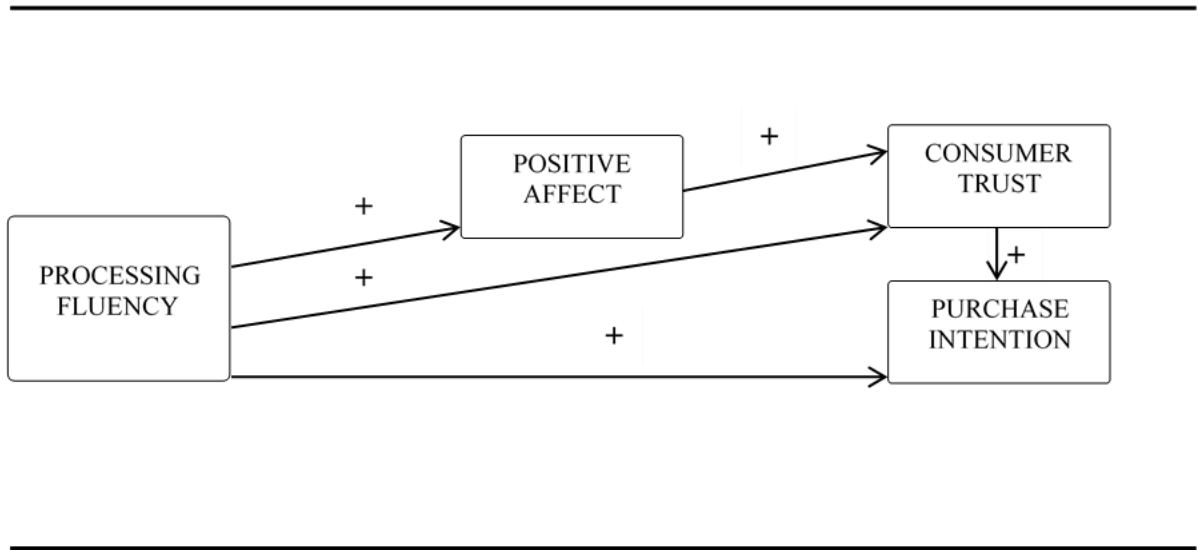
Table 5 - Scales performance comparison

	Contrast manipulation		Font manipulation		Readability manipulation	
	New scale	Old scale	New scale	Old scale	New scale	Old scale
Unidimensionality	Yes	No	Yes	No	Yes	No
Factor item loadings > 0.7	0.73 – 0.93	0.37 – 0.96	0.74 – 0.96	0.50 – 1.00	0.86 – 0.96	0.60 – 0.99
Item error variance < 0.5	0.05 – 0.07	0.81 – 0.86	0.05 – 0.07	0.26 – 0.35	0.05 – 0.06	0.21 – 0.26
Shared variance > 0.5	0.72	0.66	0.79	0.66	0.85	0.71
Reliability > 0.7	Yes (0.91)	Yes (0.79)	Yes (0.93)	Yes (0.81)	Yes (0.96)	Yes (0.87)
Nomological validity	Yes	No	Yes	Yes	Yes	No
Model fit	$\chi^2(3) = 0.57$ AGFI=0.97 RMSEA<0.05	$\chi^2(3) = 0.57$ AGFI=0.97 RMSEA<0.05	$\chi^2(3) = 0.60$ AGFI=0.97 RMSEA<0.05	$\chi^2(3) = 0.27$ AGFI=0.98 RMSEA<0.05	$\chi^2(3) = 1.34$ AGFI=0.94 RMSEA=0.04	$\chi^2(3) = 1.38$ AGFI=0.93 RMSEA=0.06

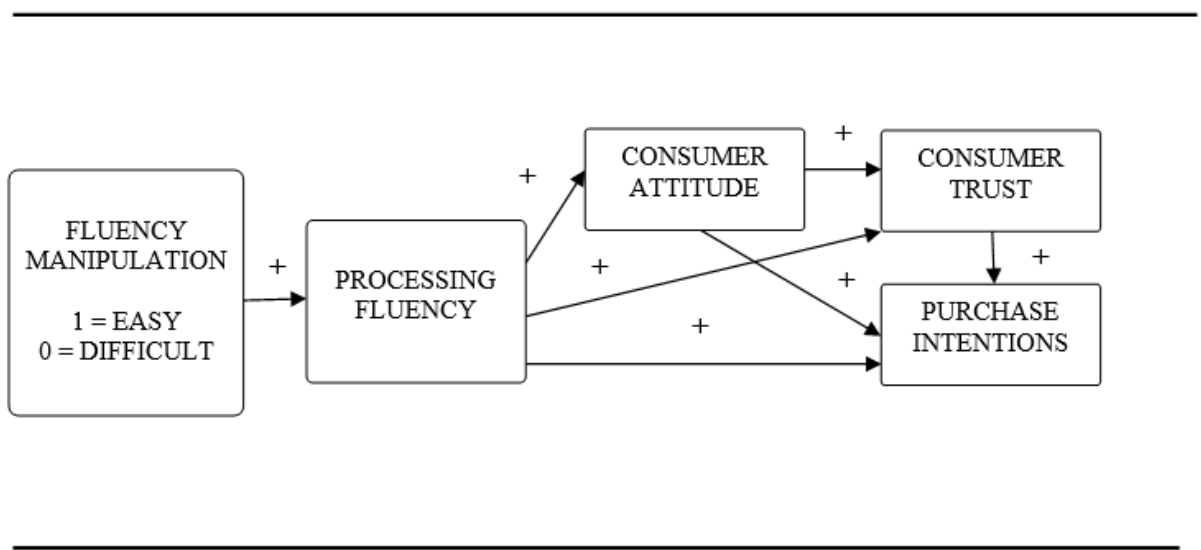
Appendix A

Structural Models for Studies 1-4

Structural model for Study 1



Structural model for Studies 2-4



Appendix B

**Contrast Manipulation: high figure-ground contrast (top image)
and low figure-ground contrast (bottom image) stimuli**

HYDRATION



ON THE GO



Appendix C

Font Manipulation: easy-to-read font (top image) and difficult-to-read-font (bottom image) stimuli

Product features:

1.2 GHz quad-core Qualcomm processor
1 GB RAM Memory
32GB storage memory
Dual-Band Wi-Fi
Bluetooth
7" WXGA Display (1280x800 Resolution)
Camera Resolution 5.0MP, 1080p HD Video Recording
Free monthly access to all apps in the app store

Price: \$149.99

Product features:

1.2 GHz quad-core Qualcomm processor
1 GB RAM Memory
32GB storage memory
Dual-Band Wi-Fi
Bluetooth
7" WXGA Display (1280x800 Resolution)
Camera Resolution 5.0MP, 1080p HD Video Recording
Free monthly access to all apps in the app store

Price: \$149.99

Appendix D

Readability Manipulation: high readability (top paragraph) and low readability (bottom paragraph) stimuli

Create the perfect office space with this Desk with Bookshelves. This desk fits nicely in a corner to maximize your home office space. The large desk top surface offers plenty of room for your monitor or laptop, as well as papers and other essential office supplies. There are two openings built into the desk to organize and manage your cords. Two open shelves on the side of the desk provide a perfect home for your binders and books but keep them within easy reach.

Fashion an impeccable workplace space with this Desk with Bookshelves. This desk positions attractively in a corner to take full advantage of your home-based workplace space. The outsized desk top surface provides sufficient room for your monitor or laptop, along with documents and other indispensable workplace materials. There are two apertures built into the desk to consolidate and manage your cables. Two unenclosed shelves on the side of the desk provide an impeccable home for your binders and books but retain them within stress-free reach.